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GUIDE TO ON-SITE INVESTIGATIONS OF FISH KILL INCIDENTS.(U)
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USAF OEHL TECHNICAL REPRINT

GUIDE TO ON-SITE INVESTIGATIONS OF FISH KILL INCIDENTS

MARCH 1978

Approved for public release; distribution unlimited

USAF Occupational and Environmental Health Laboratory
Operations Technical Division (AFOEHL)
Brooks Air Force Base, Texas 78235

PREFACE

This material was written for applicability, currency and completeness by personnel of the Environmental Assessment Branch, Consultant Services Division, Occupational and Environmental Health Laboratory, Aerospace Medical Division, AFSC, Brooks Air Force Base, Texas 78235. The material contained in this reprint is from Chapter III of the "Water Environment Sampling Manual" which was originally prepared in 1975 by personnel of OL AF USAF SAM, Kelly AFB, Texas. The USAF Occ. Sampling Manual is currently being revised and this material will be included in the new publication. Because of the frequent questions received by the Branch, it is felt that this chapter should be reprinted under separate cover to expedite its movement into the hands of those people needing it now to answer questions dealing with fish kill incidents. Secondly, a separate publication dealing with this specific problem is needed to provide information to base personnel working in the areas of ecology, wildlife management, and environmental quality but not directly with the occupational aspects of environmental health.

This Reprint has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This Technical Reprint has been reviewed and is approved for publication.

WILLIAM E. MARSH, Colonel, USAF, BSC
Commander

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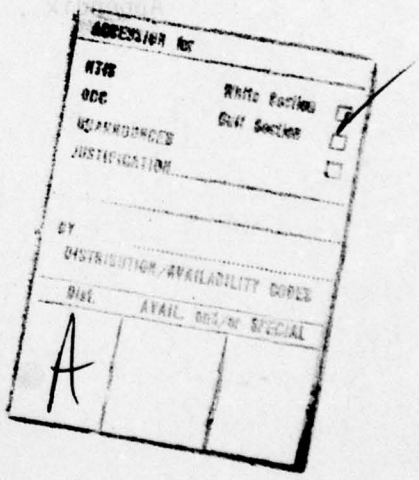
FOREWORD

This reprint has been prepared as a guide to the on-site investigation of a fish kill incident. Although the procedures presented are generalized, their utilization will allow adequate investigation of most fish kills. Since direct communication between user organization and the USAF Occupational and Environmental Health Laboratory is authorized by AFR 161-17, such communication is recommended in the event of a fish kill for which the procedures are felt inadequate or when questions arise regarding on-site investigation or regarding interpretation of written reports from this Laboratory.



GUIDE TO ON-SITE INVESTIGATIONS

OF FISH KILL INCIDENTS

INDEX

SECTION A. INTRODUCTION

1. Each year man's activities directly or indirectly cause many incidents of water pollution that result in the death of thousands of fish and numerous other aquatic organisms. A review of literature concerning fish kills, including occurrences on Air Force installations, has revealed three important considerations. First, the majority of kills for which the cause has been determined could have been prevented or their extent greatly diminished by an established, sound environmental protection program. Second, many investigations of kills were concluded without determination of cause. In most cases, inability to determine cause has been attributed to the lack of a thorough, accurate, on-site investigation of the occurrence. Third, the possible legal implications and liabilities associated with fish kills are becoming more complex and stringent which further necessitate thorough and accurate investigation.

2. Referring specifically to fish kills on Air Force installations, AFR 19-1 (Feb 74), required the submission of a Pollution Incident Report to specified agencies if the incidents are detrimental to aquatic species of plants or animals or are a possible cause of unfavorable publicity for the Department of Defense or its agencies. It is anticipated that the pending regulation, AFR 19-8, "USAF Oil and Hazardous Substance Pollution Contingency Plan" will contain the same reporting requirements. Completion of Pollution Incident Reports (initial, interim and final) on fish kills requires thorough investigation by installation personnel plus considerable biological consultative support.

3. Support in investigating fish kills can be furnished by the USAF Occupational and Environmental Health Laboratory (USAF OEHL), Brooks AFB TX, which provides consultative, analytical and biological services to Air Force installations. Since USAF OEHL does not routinely conduct on-site investigations of fish kills, this guide has been prepared to provide information to the field on the following:

a. Causes of fish kills.

b. Potential sources of causes of fish kills on Air Force installations.

c. Possible preventative measures.

d. Guidelines for on-site investigation of a fish kill.

e. USAF OEHL role in fish kill investigation.

f. Possible legal implications of fish kills.

SECTION B. CAUSES OF FISH KILLS

1. Fish kills result from a variety of causes such as genetically controlled physiologic changes, diseases or parasites, insufficient oxygen, starvation, physical injury, mechanical interference with required physiological functions, and exposure to toxic substances. The sources of any of the above causes may be naturally occurring, or they may be man-caused.

2. An example of genetically controlled physiologic changes causing the death of fish can be found among many salmon species which die in large numbers shortly after spawning activities are completed. In some species certain individuals or populations inherit higher susceptibility (i.e. - it reduces their tolerance) to diseases, parasites or toxins. Such reduced tolerances does not automatically result in a major fish kill. Conditions remain normal as long as none of the diseases, parasites, or toxins to which the fish are highly susceptible are present. However, such conditions do complicate fish kill investigations because the genetic conditions of fish populations are usually not known and because inherited susceptibility increases the number of possible causes of fish kills. The prevalence of susceptible individuals or populations may be increased by man's activities through introduction of susceptible animals into an otherwise tolerant population (through accident or ignorance) or by the introduction of mutagenic agents which typically lead to a decrease in a population's fitness or ability to survive in the existing environment.

3. All living organisms are subject to naturally occurring diseases or parasites. Death from diseases and parasites in fish (and other organisms) occurs continually but generally goes unnoticed because only a few individuals die in a given area at one particular time. Occasionally, however, epizootic conditions occur in large concentrated populations and result in many deaths in a short period of time. Man has sometimes triggered an epizootic kill by accidental introduction of pathogens into bodies of water where they were not previously found or by imposing stress factors that lessened or eliminated natural tolerance or immunity to existing pathogens.

4. Almost all bodies of water, at least near the surface, contain dissolved oxygen (DO). The amount, or concentration, of dissolved oxygen varies from one body of water to another and varies with location, depth, time of day, and season. In order to support a fish population, depending on the species of fish, the DO concentrations generally must remain above 4-6 parts per million. Any conditions or substances which cause a reduction in DO are potentially harmful to fish. Organic materials entering a body of water provide increased substrate for metabolism and decomposition by aquatic microorganisms, which in turn exert an increased biochemical oxygen demand (BOD). Spontaneous, oxygen-requiring chemical reactions also may be generated and exert an oxygen

demand. Such conditions decrease the oxygen concentration of the receiving water. If this decrease causes the DO level to fall below that required to support fish, a kill occurs. Sources of BOD loading include treated and untreated wastes and wastewaters, surface run-off, and organic soil freed by erosion.

5. Starvation occurs when food resources are rapidly depleted or otherwise made unavailable. Fish kills attributable to starvation have many causes, two of which seem to occur more often than the others. First is the introduction of toxic substances into the receiving water which kill off fish food organisms. Heavy siltation is the second cause, as it reduces light penetration thereby decreasing plant growth. Silt also covers or coats eggs and small bottom organisms thereby killing them or hiding them from the fish.

6. Physical injury results from any actions which injure fish beyond their ability to recover. Most often, natural events such as hurricanes, tornadoes and earthquakes are the causes, but in small bodies of water or portions of larger ones such things as dumping of solid wastes and construction or explosions could be the source.

7. Mechanical interference with respiratory functions occurs when materials such as silt and petroleum compounds are introduced. Either of these materials can coat the gill surfaces and prevent oxygen uptake.

8. Introduction of substances toxic to fish may seem to be a simple category which results in an immediate and obvious fish kill; however, this is not the case. Many organisms continually liberate materials toxic to fish. Usually the amounts are very small, but under certain conditions toxic species become extremely abundant (such as red tide in the ocean) and cause massive kills. In most lakes, periods of water turnover and mixing occur seasonally. Between turnovers small sublethal amounts of toxic substances may enter the water and settle out in the bottom sediment. Examples are known where mixing periods have freed these materials in lethal amounts. Direct introduction of toxic substances occurs in the same ways noted above for introduction of materials exerting increased BOD. If the amounts of toxic materials are sufficient to cause an immediate kill the concentration is an acute level. At other times levels are said to be chronic in which cases death results from continued exposure over a period of days, weeks, or even months.

9. Additive or synergistic effects of several environmental or physiological factors can cause an eventual fish kill. For example, starvation or inadequate levels of dissolved oxygen can make fish more susceptible to toxic substances such as mercury or lead.

10. No criteria are known to readily distinguish between naturally occurring and man-caused fish kills. Distinction must be made on the basis of sound investigative procedures. Considering kills occurring on Air Force installations, all such incidents should be considered man-caused until proven otherwise.

SECTION C. POTENTIAL SOURCES OF CAUSES OF FISH KILLS ON AIR FORCE INSTALLATIONS

1. By the nature of their missions, Air Force installations have many facilities which can contribute hazardous materials to the bases' effluent receiving systems. Many fish kills result from discharge of hazardous materials into the aquatic environment which have an immediate lethal effect, deplete the available dissolved oxygen or eliminate food sources. In an effort to assist on-site investigators in determining the source of pollutants causing a fish kill, a brief discussion is given here of some of the more common activities discharging hazardous waste and the materials involved with each of these activities.

2. Industrial shops are primary sources for the discharge of materials toxic to fish. If improperly treated, these materials can lead to fish kills and can render receiving waters unfit for aquatic life. Table I lists the shops in this category and some of the potential toxicants they release.

3. Most heavy metals are extremely toxic to fish even in low concentrations. Shops such as plating shops, paint stripping facilities and photographic shops usually account for most of a base's total output of heavy metals. These metals, in high concentrations, can be acutely toxic and account for a rapid fish kill; or their slow, low-level release into a receiving water can cause a gradual depletion of the fish population either by a direct but slow kill (i.e. two or three at a time) or through elimination of fish food sources.

4. Photographic wastes are toxic to fish. This toxicity can be attributed to their high oxygen demand along with the presence of heavy metals, toxic organic compounds, and organic acids. Color processing wastes are much more toxic than black and white processing, but both are sufficiently toxic to be of concern.

5. Petroleum, oil and lubrication (POL) facilities are, of course, a source of toxic pollutants. Oils and fuels can cause death of fish by their toxic actions, the physical coating of gills or their adverse effects on fish food organisms.

6. Sources of pollutants that are often overlooked are automobile and aircraft wash racks. A heavy load of oils, greases, detergents, surfactants, and solvents can be released to a receiving system by heavy use of these facilities when discharges are inadequately treated.

7. Two other facilities that are often implicated in fish kills are the industrial waste treatment plant and the domestic sewage treatment plant. Materials processed through these plants can impose a high BOD when released into receiving waters thereby depleting the dissolved oxygen. Nutrients can be released causing prolific plant growth which may eventually die off. As this large mass of dead plant material starts to decompose, a BOD is exerted and the dissolved oxygen can be depleted. An inefficient treatment operation can allow these harmful processes to occur. Toxic materials can also pass through the plant unchanged and still be toxic or degraded into toxic constituents.

TABLE I

POTENTIAL SOURCES OF TOXIC MATERIALS AND CONDITIONS CAUSING FISH KILLS AT AIR FORCE INSTALLATIONS

SOURCE	POLLUTANTS, TOXICANTS
Sewage Treatment Plant	Detergents, nitrates, phosphates, materials with high BOD or COD.
Industrial Waste Treatment Plant	Same materials as from Plating Shops, Paint Stripping Shops, etc.
Plating Shops	Cadmium, chromium, zinc, nickel, manganese, cyanide, acid, alkali
Paint Stripping Shops	Nickel, cyanide, chromium, materials with high COD, phenols, caustic agents
Photographic Shops	Toxic organic compounds, organic acids, materials with high COD, heavy metals, cyanide.
Wash Racks, Vehicle Maintenance Shops, Corrosion Control Shops	Oils, grease, detergents, industrial solvents.
POL Facilities	Oils, fuels.
Golf Courses	Pesticides.
Runway de-icing and aircraft anticing/de-icing operations	BOD, ammonia, nitrates, urea

8. The misuse of pesticides is another common cause of fish kills on Air Force installations. Golf courses are the main users of pesticides due to the need for continuous control of insects, weeds and fungi. Insecticides, herbicides and fungicides are applied to golf courses at substantial rates. These materials are toxic to fish when present at elevated concentrations in the aquatic ecosystem. Pesticides can enter the aquatic habitat by runoff from the treated areas, by drift into water from nearby spray operations, and by direct treatment of the water for control of aquatic weeds and algae. Due to the persistence of the active ingredient (toxic material), some pesticides applied several days before a rain may still be toxic if washed into receiving waters. In cases of chlorinated hydrocarbon insecticides, this toxicity may persist for years.

9. Although of only occasional concern, construction near bodies of water may lead to fish kills. Removal of cover vegetation allows rapid erosion and runoff of surface soils. This in turn is the cause of high silt in the receiving water which can clog gills or increase turbidity of the water thereby reducing natural algae growth. Chemicals and fuels associated with construction equipment and materials may be found in the upper layers of soil at sufficient concentrations to affect receiving waters and cause a fish kill.

10. These examples are given primarily as those of acute fish kill situations. However, at low levels all the materials mentioned can cause a chronic fish kill situation.

SECTION D. POSSIBLE PREVENTATIVE MEASURES

1. Prevention of fish kills or lessening their total effect is the responsibility of base level personnel. Personnel responsible for on-site investigations of fish kills should acquaint themselves with those activities at their installation that might be the source of the problem. These include those listed in Table I and possibly others unique to a specific installation. Direct contact with the personnel at these activities should be accomplished to:

a. Insure that such shops have proper treatment of waste materials and that recommended corrective measures are taken when potentially hazardous conditions are found.

b. Stress the need for immediate reporting of accidental release or spill of toxicants or hazardous materials to sewage treatment plant or industrial waste treatment plant personnel since these activities may be able to prevent or lessen the toxic effect.

c. Stress the need for reporting accidental release or spill to the office responsible for fish kill investigation so that preventative measures or advance preparation for an investigation can be accomplished.

d. Implement these preventative measures through an active and vigorous base-wide education program.

e. Insure that the installation Environmental Protection Committee has approved all fish kill contingency plans and that reports of all fish kill incidents, or similar occurrences, are discussed during meetings of the Committee.

SECTION E. GUIDELINES FOR ON-SITE INVESTIGATION OF A FISH KILL

1. An awareness of possible causes and potential hazards is helpful in determining the cause of a kill, but the most important factor is getting a qualified person to the site of the kill as soon as possible. The importance of rapid on-site investigation cannot be over-emphasized. Dead fish decompose rapidly, especially in warm weather, and it is impossible to obtain useful data from necropsies and tissue analyses of decomposed fish. Typically a kill results from an introduction of a "slug" of toxicant. Delayed arrival on-site often allows the toxicant to be diluted or degraded to such a degree that it can no longer be detected or, when flowing water is involved, allows the toxicant to be carried a considerable distance downstream. Rapid response may allow the investigator to observe and note the behavior of dying fish, and such information often gives considerable insight as to the cause of death.

2. Prior preparation is of importance in a fish kill investigation. Personnel responsible for investigation should have on hand the necessary and proper equipment and supplies. Time lost in obtaining equipment or supplies prevents rapid on-site investigation and sample collection.

3. Upon reaching the site of a kill, the investigator should accomplish the following:

a. Assess the extent of kill.

b. Determine pH, DO, and temperature of affected water and representative unaffected water.

c. Collect water samples for chemical analysis at USAF OEHL from the same locations used in paragraph b above.

d. Collect representative samples of affected organisms.

e. Record all facts and observations concerning the fish kill.

4. Extent of Kill: Determine the size of the affected area and the numbers, kinds, and sizes of fish involved. Also note other kinds of organisms killed, such as salamanders, frogs, turtles, aquatic insects, crayfish, etc.

5. pH, DO and Temperature: Equipment for determining pH and temperature should always be available, but equipment for determining DO such as an electronic probe type DO meter, is seldom available to those individuals responsible for on-site investigation. If such is the case, arrangements should be made with sewage treatment plant personnel or other organizations for such determinations. All three values should be determined at the following locations: at least two points in the immediate kill zone; in stream situations, at one point above the kill and 2-3 points downstream (downstream points should include any area where fish are dying or where any unusual behavior of fish or other aquatic animals is noted and at least one point where all conditions appear normal); in lake or ponds, 2-3 points away from the kill zone, if possible.

6. Water samples should be taken at the same sites where pH, DO and temperature are measured. When these samples are shipped to USAF OEHL they should be accompanied by the proper sample submission forms; "Non-Potable Water Analysis," OEHL Form 1, and/or "Water Analysis for Pesticides," OEHL Form 3. Copies of these forms are in the Appendix. The submission form for chemical constituents, OEHL Form 1, divides analyses by preservation group (Table II). The analyses are grouped into categories, each of which requires a different combination of container, preservative and sample volume (Table III).

a. In all fish kill investigations, also immediately collect approximately eight liters of water from the site of the kill and, if possible, from an unaffected portion of the same body of water. Add no preservatives to this water and ship to USAF OEHL for aquatic bioassay.

b. In some fish kill investigations, pesticide analyses of the water are required. The water samples for pesticide analyses must be collected in clean glass containers and capped with teflon-lined or aluminum foil-lined (dull side in contact with sample) lids. Plastic containers are unacceptable for containing water samples to be analyzed for pesticides. For the purposes discussed in this report, clean glass containers are those that have been washed with 5% nitric acid, rinsed with distilled water, rinsed with acetone, air dried and then capped.

c. The instructions for filling out both OEHL Form 1 and 3 are located on the back of the forms. The top of the form should be filled out as completely as possible and the sample containers clearly labelled with the installation name, sample site number, and the preservative used. Place return address in Block 1.

7. Representative Samples of Affected Organisms: The number of organisms killed, in part, will determine the number of specimens included in a representative sample. Preferably 10 individuals of each species of fish should be collected. However, when fewer than 10 of a given species are affected, all should be collected. Good judgement is

TABLE II

Listed below are typical water analyses within the USAF Occupational and Environmental Health Laboratory capabilities, divided in groups based on sample volume, container, and preservation requirements. These requirements are given in the attached table for each Preservation Group.

PRESERVATION GROUP A

Chemical Oxygen Demand
Total Organic Carbon

PRESERVATION GROUP B

Oil/Grease

PRESERVATION GROUP C

Ammonia
Nitrate
Nitrite
Total Kjeldahl Nitrogen
Phosphorus - Ortho
Phosphorus - Total

PRESERVATION GROUP D

Cyanide
Cyanide-free

PRESERVATION GROUP E

Phenols

PRESERVATION GROUP F

Arsenic
Barium
Cadmium
Calcium
Chromium
Chromium-Hexavalent
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Zinc

PRESERVATION GROUP G

Acidity
Alkalinity
Boron
Chloride
Color
Fluoride
Hardness
Residue
Specific Conductance
Sulfate
Surfactants
Turbidity

PRESERVATION GROUP H

Pesticides

TABLE III

SAMPLE VOLUME, CONTAINER, AND PRESERVATION REQUIREMENTS
FOR THE CATEGORIES OF ANALYSES GIVEN IN TABLE II

PRESERVATION GROUP	MINIMUM VOLUME[1]	CONTAINER TYPE	PRESERVATIVE[2]
A	100 ml[3]	Plastic	Add 0.2 ml concentrated sulfuric acid/100 ml.
B	1000 ml	Glass	Add 2 ml concentrated sulfuric acid/1000 ml.
C	1000 ml	Plastic	Add 2 ml concentrated sulfuric acid/1000 ml.
D	1000 ml	Plastic	Add 8 sodium hydroxide pellets/1000 ml. Neutralize oxiding agents with ascorbic acid.[4] Then add an additional 0.6 mg ascorbic acid/1000 ml.
E	1000 ml	Glass	Add concentrated phosphoric acid to pH 4, plus 1 gm copper sulfate/1000 ml.
F	1000 ml[5]	Plastic	Add 5 ml concentrated nitric acid/1000 ml.
G	1000 ml[5]	Plastic	None.
H	2000 ml	Glass	Submit sample unpreserved, and use a Teflon(R) or aluminum foil (dull side in contact with sample) liner in the bottle cap. Use two 1000 ml bottles.

[1]A one quart sample is an acceptable substitute for a 1000 ml sample.
[2]Do not add preservative if it will cause an adverse or unsafe reaction with the sample, especially with industrial process samples. For example, in the oil/grease analysis (Preservation Group B) of a cyanide plating tank solution, DO NOT add sulfuric acid. Contact the USAF Occupational and Environmental Health Laboratory for guidance in these situations.
[3]Can be included in the 1000 ml of Preservation Group C if both are submitted.
[4]Test a drop of the sample with potassium iodide - starch test paper (KI-starch paper); a blue color indicates the need for treatment. Add ascorbic acid a few crystals at a time until a drop of sample produces no color on the indicator paper.
[5]If analyses for dissolved constituents are requested, the minimum sample volume must be filtered through a 0.45µ membrane filter before preservation. If both dissolved and total analyses are requested in a preservation group, then two separate preserved volumes must be submitted for that group, one filtered, one unfiltered. A filtered sample should be labelled with the normal labelling but with the Preservation Group letter code followed by "filtered."

necessary when collecting fish. Ten 6-pound bass would not be necessary, three would be adequate. In general, small fish require larger numbers in samples and conversely, larger fish require lesser numbers. Fish should be collected as soon as possible, wrapped in aluminum foil with dull side in contact with fish, placed inside plastic bags or other containers, and frozen as soon as possible. DO NOT COLLECT DECOMPOSED FISH. Representatives of the same species taken from outside the zone of kill but in the same body of water should be collected, if possible. Turtles, frogs, and other vertebrate animals should be handled in like manner. Invertebrates (such as aquatic insects, crayfish, clams, etc.) also should be handled in this manner, but numbers of individuals should be increased for small forms. All samples should be labelled in the same manner as indicated for water sample.

8. Shipment of Biological Samples:

a. The policy of USAF OEHL is not to analyze fish tissues until a substantiated causative agent is determined. The time and effort that is expended in analyzing tissue for all possible toxicological agents is prohibitive. Unless the suspected cause can be substantiated by either analysis of the water samples or death of bioassay fish after exposure to the water sample at USAF OEHL the tissue samples are not analyzed. Therefore, specimens of affected organisms should be maintained by the on-site investigator and not shipped to USAF OEHL until the water samples have been analyzed and a possible causative agent identified. After notification from USAF OEHL that fish samples are required, the investigator should prepare the specimens for shipment. They must be shipped by the fastest possible method, usually commercial airlines. The samples should be clearly marked as frozen specimens and packed on dry ice.

b. Biological samples can also be submitted to USAF OEHL for identification of species. These fish can be preserved in formaldehyde, formalin, or alcohol and shipped with the water samples.

9. Observations: While on site, the investigator should note all conditions of potential importance. Some of the more important observations include the following:

a. Behavior of dying fish.

b. Rate of stream flow.

c. Prevailing weather conditions.

d. General appearance of water.

e. Presence of oils, grease, and scum.

f. Presence of algae.

g. Behavior of other organisms.

10. Rate of stream flow may be an important factor regarding water samples. If it is suspected that a "slug" of toxic material entered the stream and if the time of entrance is known, the rate of flow can be used to estimate the downstream position of the toxicant and, if possible, water samples should be obtained from this location. When a "slug" of toxic material is known to have been released into flowing water, immediate consideration for downstream users is imperative. Determination of identity and amount of toxicant released may allow treatment of the "slug" to eliminate or reduce downstream effect. At a minimum, warnings should be issued to downstream users, especially in cases where the material is toxic to humans.

11. After completion of on-site investigation, all water samples and frozen specimens (when requested by USAF OEHL) should be forwarded to USAF OEHL. Water samples and frozen specimens are to be shipped on a Government Bill of Lading (GBL) by air express. Before shipping, contact USAF OEHL, AUTOVON 240-3667, and provide the name of the airline, the flight number, and the estimated time of arrival. Also, obtain from USAF OEHL the name of the Laboratory Duty Officer and have his name noted on the GBL. If possible, include a map of the area labelled to show the Sewage Treatment Plant and the Industrial Waste Treatment Plant and their outfalls, storm drainage, the area of the kill, and other pertinent data. The field investigator should contact USAF OEHL by telephone as soon as possible after completion of the on-site study. Contact personnel normally are those assigned to Environmental Assessment Branch, Consultant Services Division, USAF OEHL. Be prepared to furnish USAF OEHL with additional information, such as:

a. Description of the affected body of water.

b. Drainages (and effluents) into this body of water.

c. History of recent discharges or runoff into affected water including source, time and any unusual contents of the discharges.

d. Name, office symbol and telephone number of the requestor.

e. Item 3 in the Appendix is a copy of the form used by USAF OEHL in recording a fish kill. The field investigator should be prepared to answer as many of the questions as possible.

SECTION F. OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY ROLE IN FISH KILL INVESTIGATIONS

1. USAF OEHL personnel are always available for consultation on fish kill incidents or to answer questions related to any aspect of this document. Normally, personnel of the Environmental Assessment Branch, Consultant Services Division (AUTOVON 240-3667, Commercial 512/536-3667)

are responsible for fish kill investigations. Duty hours are usually sufficient for consultations on fish kills, but in cases where the field investigtor needs immediate support during other hours USAF OEHL personnel may be contacted through Brooks AFB Command Post, AUTOVON 240-3278.

2. After coordination with the on-site investigator, USAF OEHL will determine what laboratory analyses should be accomplished. Typically a bioassay and a complete water analysis will be accomplished. Analysis for specified pesticides will be done on request. Necropsy, gross examination, and chemical analysis of tissues will be carried out on frozen specimens if necessary. Biologists at USAF OEHL will interpret results of all tests and forward a report to the requesting base.

SECTION G. POSSIBLE LEGAL IMPLICATIONS OF FISH KILLS

1. Air Force policy is that all Air Force installations are required to comply with Environmental Protection Agency guidelines, or State Water Quality Standards, whichever are more stringent. Fish kills are, in most cases, covered by state laws, and can result in court actions against the person or installation responsible for the kill. Because laws governing fish kill incidents vary considerably in different states and because these laws are periodically revised, no attempt is made to discuss specifics. More precise information of the legal implications may be obtained from the Staff Judge Advocate. Also, each installation is required to have a Base Oil and Hazardous Substance Spill Contingency Plan, and this document should be periodically reviewed.

2. The possibility of legal action following a fish kill incident again emphasizes the need for rapid response and accurate on-site investigation. Remember that any or all personnel involved in an investigation might be called on to testify in a court action.

GLOSSARY

1. Biochemical Oxygen Demand (BOD) - the amount of oxygen removed (used) from water as a result of waste decomposition by microscopic organisms in the water.

2. Decomposition - the complete breakdown of chemical materials into their component elemental parts; in water, industrial and domestic waste decomposition occurs as a result of a combination of chemical reactions and the biological activity (metabolism) of many kinds of microscopic organisms.

3. Ecosystem - a system, or complex, made up of a community of animals, plants, and bacteria and the physical and chemical environment with which it is interrelated.

4. Epizootic - an epidemic among animals other than man.

5. Genetics - the study of heredity or the study of the transmission of traits.

6. Metabolism - the sum of all of the chemical and physical processes occurring in an organism and essential to that organism's survival and ability to reproduce.

7. Mutagenic - capable of causing permanent change in the genetic structure of an organism; can result from exposure to various chemicals and types of radiation; the great majority of such induced changes in genetic structure (in the DNA) are harmful and may cause death of the exposed individual or lead to production of off-spring with greatly reduced potential for survival, the latter because offspring inherit, or receive, their genetic structure from their parents.

8. Necropsy - the examination of a dead body including dissection and microscopic examination of selected parts; a post-mortem examination.

9. Parasite - an organism that lives on or in another organism (the host) and receives benefit (such as food) while causing harm to the host.

10. Physiological - referring to the normal functioning of the various vital organs (gills, heart, muscles, etc.) of an organism.

11. Sublethal - less than lethal amount.

12. Substrate - the material on which water microorganisms live and feed.

13. Synergism - an additive effect such that the combination of two nontoxic levels present becomes toxic.

14. Voiding - emptying, vacating, clearing.

15. Water turnover - the thorough mixing of the water in many lakes occurring seasonally when water temperatures and other physical features are nearly equal at all depths.

APPENDIX

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER 00005	4. REQUESTOR SAMPLE NUMBER 00026

SAMPLE COLLECTION INFORMATION			5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
7. SITE DESCRIPTION			ON-SITE ANALYTICAL RESULTS	
8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	16. WATER TEMP 00010 °C	17. PH 00400 UNITS
11. COLLECTION DATE/PERIOD		12. NAME OF COLLECTOR	19. RESULTS OF OTHER ON-SITE ANALYSES	
13. SAMPLING TECHNIQUE		14. PHONE NUMBER		
15. REASON FOR SAMPLE SUBMISSION NPDES #				

18. DISS O2 00300 MG/L

ANALYSES REQUESTED AND RESULTS

A. PRIMARY DRINKING WATER STANDARDS (40CFR 141) (Preservation Group H)

PARAMETER	TOTAL	µG/L	MAX LEV ALLWD	PARAMETER	TOTAL	µG/L	MAX LEV ALLWD
ENDRIN	39390		0.2 µG/L	2, 4-D	39730		100 µG/L
LINDANE	39782		4 µG/L	2,4, 5-TP SILVEX	39760		10 µG/L
METHOXYCHLOR	39480		100 µG/L				
TOXAPHENE	39400		5 µG/L				

B. NON-POTABLE WATER ANALYSIS FOR PESTICIDES (Preservation Group H)

PARAMETER	TOTAL	µG/L	PARAMETER	TOTAL	µG/L	PARAMETERS (SPECIFY)	µG/L
ALDRIN	39330		METHOXYCHLOR	39480			
CHLORDANE	39350		TOXAPHENE	39400			
DDT ISOMERS	39370		2,4-D	39730			
DIELDRIN	39380		2,4,5-TP SILVEX	39760			
ENDRIN	39390						
HEPTACHLOR	39410						
HEPTACHLOR EPOXIDE	39420						
LINDANE	39782						

1. ORGANIZATION REQUESTING ANALYSIS	CHEMIST
	REVIEWED BY
	APPROVED BY

OEHL FORM NOV 76 3 — WATER ANALYSIS FOR PESTICIDES

1. Complete one set for each sample submitted.

2. Use OEHL Form 1, Non-Potable Water Analysis, for all non-potable water analysis (such as stream surveillance sample, fish kill water, waste treatment effluent analysis, etc.) unless pesticide analysis is desired.

3. Use OEHL Form 2, Potable Water Analysis, for all drinking water analysis unless pesticide analysis is desired.

4. Use OEHL Form 3, Water Analysis for Pesticides, for all water samples when pesticide analysis is desired.

BLOCK NO.	INSTRUCTIONS
1.	Name and mailing address of activity submitting sample.
2.	Name and mailing address of laboratory performing analysis.
3.	Reserved for laboratory performing analysis.
4.	The sample number assigned by the requesting organization for local sample control. This should be an eight digit number defined as follows: a. The first digit indicates the reason for sampling, with these values: 1 - routine monitoring sample 2 - check sample, for verfication of previous sample 3 - special purpose sample, taken as the result of some unusual activity at the sampling site, i.e., disinfection of a water main, chemical spill in a stream, etc. b. The second digit indicates the person collecting the sample. A number from 1 to 9 should be locally assigned to each collector, and a record kept of the period of time during which he held the number, to permit subsequent reuse of the values as needed. c. The third and fourth digits are the last two digits of the year during which the sample was taken d. The fifth through eighth digits are the sequential number of the sample relative to the total number of environmental monitoring samples of all types (water for pesticide, non-potable water, air pollution, industrial hygiene, radiation, etc.) taken that year.
5.	Reserved for laboratory performing analysis.
6.	Reserved for laboratory performing analysis.
7.	A brief word description of where the sample was taken. (< 32 letters.)
8.	Site identification number, assigned by the installation IAW Atch 1, AFR 19-7.
9.	Flowrate at sampling site, in gallons per minute.
10.	Weather conditions. See Table 1, General Instructions for Water Sample Submission to the USAF OEHL.
11.	If sample is a grab sample, specify date and time of collection. If sample is a composite, specify starting and ending date and time. Use the 24-hour clock system for specifying time.
12.	Name of person who collected the sample.
13.	Specify sampling depth, sampling equipment and frequency of compositing (if applicable).
14.	Phone number at which the sample collector can be reached. Specify Autovon or Commercial (preferably Autovon for samples submitted to Air Force laboratories).
15.	State reason for sampling , e.g., routine mandated monitoring, routine local policy monitoring, validation of previous result, special purpose sample for fuel spill, fish kill, etc.
16.	Water temperature at time of collection, in degrees Centigrade (Celsius).
17.	pH at time of collection, in standard pH units.
18.	Dissolved oxygen at time of collection, in mg/l.
19.	List all other analysis performed on site and the results of any completed analysis. Results of BOD or other tests which would have delayed sample submission, should be sent to the laboratory by telecon (CONUS) or message (overseas), referencing requestor's sample number, Block 4.
ANALYSES REQUESTED	Circle analyses code numbers corresponding to the parameters for which analyses are desired. Submit sample per General Instructions for Water Sample Submission to the USAF OEHL.
REMARKS	Use this section for continuation of any of the above items.

2. LABORATORY PERFORMING ANALYSIS	3. LAB SAMPLE NUMBER 00008	4. REQUESTOR SAMPLE NO 00029

SAMPLE COLLECTION INFORMATION			5. DATE RECEIVED BY LAB	6. DATE ANALYSIS COMPLETED
7. SITE DESCRIPTION				
8. SITE LOCATION NO	9. FLOWRATE AT SITE 00058 GAL/MIN	10. WEATHER 00041	ON-SITE ANALYTICAL RESULTS	
11. COLLECTION DATE/PERIOD	12. COLLECTOR'S NAME		16. WATER TEMP 00010 °C	17. PH 00400 UNITS
13. SAMPLING TECHNIQUE	14. PHONE NUMBER		18. DISS O_2 00300 MG/L	19. RESULTS OF OTHER ON-SITE ANALYSES
15. REASON FOR SAMPLE SUBMISSION NPDES #				

ANALYSES REQUESTED AND RESULTS

PRESERVATION GROUP A			PRESERVATION GROUP B			PRESERVATION GROUP C		
PARAMETER	TOTAL	MG/L	PARAMETER	TOTAL	MG/L	PARAMETER	TOTAL	MG/L
Chemical Oxygen Demand	00340		OIL & GREASE FREON-IR Method	00560		*AMMONIA as N*	00610	
Total Organic CARBON as C	00680					*NITRATE as N Cd Reduct. Method*	00620	
						NITRITE as N	00615	
						TOTAL KJELDAHL NITROGEN as N	00625	
						PHOSPHORUS Ortho PO4 as P	70507	
						PHOSPHORUS as P	00665	

PRESERVATION GROUP D			PRESERVATION GROUP E		
PARAMETER	TOTAL	MG/L	PARAMETER	TOTAL	µG/L
CYANIDE	00720		PHENOLS	32730	
CYANIDE Free, Amenable to Cl_2	00722				

PRESERVATION GROUP F				PRESERVATION GROUP G		
PARAMETER	DISS	TOTAL	µG/L	PARAMETER	TOTAL	MG/L
ARSENIC	01000	01002		BORON	01022	µg/l
BARIUM	01005	01007		BORON, Dissolved	01020	µg/l
CADMIUM	01025	01027		CHLORIDE	00940	
CHROMIUM	01030	01034		COLOR	00080	Units
CHROMIUM Hexavalent		01032		FLUORIDE	00951	
COPPER	01040	01042		Residue Filterable (TDS)	00515	
IRON	01046	01045		Residue Non Filt (SS)	00530	
LEAD	01049	01051		*Residue*	00500	
MANGANESE	01056	01055		*Residue Volatile*	00505	
MERCURY	71890	71900		Specific Conductance	00095	µmhos
NICKEL	01065	01067		*SULFATE as SO_4*	00945	
SELENIUM	01145	01147		SURFACTANTS MBAS as LAS	38260	
SILVER	01075	01077		TURBIDITY	00076	Units
ZINC	01090	01092				
CALCIUM as Ca	00915	00916	mg/l			
MAGNESIUM as Mg	00925	00927	mg/l			
POTASSIUM	00935	00937	mg/l			
SODIUM	00930	00929	mg/l			

PRESERVATION GROUP J		
PARAMETER		

1. ORGANIZATION REQUESTING ANALYSIS	CHEMIST
	REVIEWED BY
	APPROVED BY

INSTRUCTIONS FOR COMPLETING OEHL FORM 1

1. **Complete one set for each sample submitted.**

2. Use OEHL Form 1, Non-Potable Water Analysis, for all non-potable water analysis (such as stream surveillance sample, fish kill water, waste treatment effluent analysis, etc.) unless pesticide analysis is desired.

3. Use OEHL Form 2, Potable Water Analysis, for all drinking water analysis unless pesticide analysis is desired.

4. Use OEHL Form 3, Water Analysis for Pesticides, for all water samples when pesticide analysis is desired.

BLOCK NO.	INSTRUCTIONS
1.	Name and mailing address of activity submitting sample.
2.	Name and mailing address of laboratory performing analysis.
3.	Reserved for laboratory performing analysis.
4.	The sample number assigned by the requesting organization for local sample control. This should be an eight digit number defined as follows: a. The first digit indicates the reason for sampling, with these values: 1 - routine monitoring sample 2 - check sample, for verfication of previous sample 3 - special purpose sample, taken as the result of some unusual activity at the sampling site, i.e., disinfection of a water main, chemical spill in a stream, etc. b. The second digit indicates the person collecting the sample. A number from 1 to 9 should be locally assigned to each collector, and a record kept of the period of time during which he held the number, to permit subsequent reuse of values as needed. c. The third and fourth digits are the last two digits of the year during which the sample was taken. d. The fifth through eighth digits are the sequential number of the sample relative to the total number of environmental monitoring samples of all types (water for pesticide, non-potable water, air pollution, industrial hygiene, radiation, etc.) taken that year.
5.	Reserved for laboratory performing analysis.
6.	Reserved for laboratory performing analysis.
7.	A brief word description of where the sample was taken (< 32 letters).
8.	Site identification number, assigned by the installation IAW Atch 1, AFR 19-7.
9.	Flowrate at sampling site, in gallons per minute.
10.	Weather conditions. See Table 1, General Instructions for Water Sample Submission to the USAF OEHL.
11.	If sample is a grab sample, specify date and time of collection. If sample is a composite, specify starting and ending date and time. Use the 24-hour clock system for specifying time.
12.	Name of person who collected the sample.
13.	Specify sampling depth, sampling equipment and frequency of compositing (if applicable).
14.	Phone number at which the sample collector can be reached. Specify Autovon or Commercial (preferably Autovon for samples submitted to Air Force laboratories).
15.	State reason for sampling, e.g., routine mandated monitoring, routine local policy monitoring, validation of previous result, special purpose sample for fuel spill, fish kill, etc.
16.	Water temperature at time of collection, in degrees Centigrade (Celsius).
17.	pH at time of collection, in standard pH units.
18.	Dissolved oxygen at time of collection, in mg/l.
19.	List all other analyses performed on site and the results of any completed analysis. Results of BOD or other tests which would have delayed sample submission, should be sent to the laboratory by telecon (CONUS) or message (overseas), referencing requestor's sample number, Block 4.
ANALYSES REQUESTED	Circle analysis code numbers corresponding to the parameters for which analyses are desired. Submit sample per General Instructions for Water Sample Submission to the USAF OEHL.
REMARKS	Use this section for continuation of any of the above items.

REPORT FORM FOR FISH KILLS

Date:

Base:

Person Collecting Information:

Office Symbol:

Phone Number:

Date and Time of Kill:

Number of Fish Affected:

Number of Kinds of Fish:

Identification of Fish:

Size of Area:

Description of Water Body:

Drainage into Water Body:

Location of STP:

Suspected Toxic Chemicals:

Weather Conditions:

Plant Growths:

Color of Water:

DO:

Temp:

pH:

Behavior of Dying Fish:

Other Organisms Affected:

History of Base Action:

Sample Containers: Use ONLY CLEAN or washed, acetone rinsed, air dried glass sample containers with foil between lid and sample. Freeze fish and biological samples in aluminum foil dull side toward sample - ship most expedient method.

Materials and Samples That May be Requested: Map of area locating kill area. Two gal of affected water. One gal of water outside of affected area. Ten lbs of fish; ten fish of each kind. If possible obtain fish from unaffected area. Sediments & muds. Other organisms.